

Drywall and Metal Piercing Screws Are Covered by JIS 1125

When a transaction involves drywall screws or metal piercing screws, the specification I recommend following is JIS 1125. An explanation of the specification's metallurgical and performance requirements will be shown and explained in this article.

JIS 1125 covers screws having two different types of point designs: "drill point" and "cone point". The "drill point" type deals with the requirements for what are referred to as drill screws or self-drilling screws. The "cone point" type deals with what are generally referred to as drywall screws and metal piercing screws. In this article only the details related to the "cone point" screws will be discussed.

Following are the requirements for "cone point" screws in JIS 1125:

Hardness

Surface Hardness		Core Hardness	
Vickers Hardness	Rockwell Hardness	Vickers Hardness	Rockwell Hardness
HV 600 minimum	HRC 55 minimum	HV 240 to 450 *	HRC 20 to 45*

*When these screws will be electroplated, it is my recommendation that the high limit of the core hardness of these screws should be restricted to HV 345 or HRC 35. Screws having core hardnesses less than HRC 36 are much less susceptible to hydrogen embrittlement failures than are screws with higher core hardnesses.

The case hardness depth on "cone point" screws must be controlled within the limits specified in JIS 1125 to perform properly. If the case hardness of these screws is too shallow, the points will collapse when sheet metal piercing is attempted. If the case hardness is too deep, the screws can be very brittle and may snap in two while being installed or they may break after installation if side loads are applied to the assembly of which they are a part.

Nominal Diameter	Case Depth	
#4, #6 (2.9, 3.5)	.002" (.05 mm)	.007" (0.18 mm)
#7, #8, #10 (3.9, 4.2, 4.8)	.004" (0.1 mm)	.009" (0.23 mm)

The most effective means of accurately determining case hardness depth is by using micro-hardness testing equipment. Screws must be ground in half longitudinally, mounted and polished. A series of Vickers hardness readings

must be taken at intervals from the screw's outer surface inward until the distance at which the case hardness last indicates a value of HVC 600 is found. That last measurement of HVC 600 is considered the case hardness depth.

Experience has shown that the first case hardness reading should be taken at a depth of at least .002 inches (0.05 mm). Readings taken closer to the screw's outer surface may give a false low reading. This happens because the material is so thin the outer surface that the pressure of the tester may cause the screw to fracture.

Torsional Strength

Nominal Diameter	Minimum Inch Pounds	Minimum Nm
#4 (2.9)	11.5	1.3
#6 (3.5)	17.5	2.2
#7 (3.9)	26.5	3
#8 (4.2)	32.5	3.7
#10 (4.8)	51.5	5.8

Torsional strength should be tested using the type of equipment illustrated in this article. Screws must be gripped in split collets that are threaded to correspond to the thread of the screw being tested. These threaded split collets grip the part on the profile of the thread to prevent damage to the thread before the test is performed. If screws are clamped in a vise instead being gripped in threaded split collets, the thread is crushed and torn where the vise contacts the screw. This thread damage can cause erroneously low, misleading torsional strength test results to occur.

Depending on the exterior design of the collets they may be placed in a holder or clamped directly into the torsional test fixture. The collets must be clamped in the torsional test fixture with sufficient force to prevent the screw from rotating in the collet as the torsional test is performed. If the screw rotates in the collet during the test, the collet can be damaged and/or the test results may be incorrect.

The torsional test fixture must be adjusted so that the driver bit or socket is firmly engaged with the screw. A torque wrench is engaged in the top of the test fixture for measuring the torsional strength of the screw being tested. The torque wrench size should be selected so that the screw's torsional strength falls above the bottom 20% and below 100% of the wrench's torque capacity. Torque values below the bottom 20% of the wrenches capacity may not be accurate and if the test results are greater than 100% of the wrench's rating, the wrench can be damaged beyond repair. As an example, a wrench with a maximum torque capacity of 300 inch pounds should not be used to test screws having torsional strengths of less than 60 inch pounds or greater than 300 inch pounds.

Drilling Capability

“Cone point” drywall and metal piercing screws must be able to pierce a specified test plate in less than a specified number of seconds when driven with a driver having specified end load pressure and drilling speed (RPM). Those specified requirements are in the following chart:

Nominal Diameter	Test Plate Thickness	End Load Pressure Pounds (N)	Drilling Speed (RPM)	Maximum Driving Time (seconds)
#4 (2.9)	.022 - .026" (0.54 – 0.66 mm)	26.5 (118)	2500-3000	1.5
#6 (3.5)	.036 - .044" (0.9 – 1.1 mm)	33 (147)	2500-3000	2.5
#7 (3.9)	.036 - .044" (0.9 – 1.1 mm)	33 (147)	2500-3000	2.5
#8 (4.2)	.036 - .044" (0.9 – 1.1 mm)	33 (147)	2500-3000	3.0
#10 (4.8)	.036 - .044" (0.9 – 1.1 mm)	33 (147)	2500-3000	3.5

Test plate material and hardness: Cold rolled carbon sheet steel, number 5 temper, HRB 55 maximum.

Drill time tests must be performed using equipment having the basic elements of the equipment in the illustration in this article. The equipment must have a driver having a speed between 2500 and 3000 RPM. The driver must be fixtured so that different amounts of weight can be placed on or above the driver to provide the specified amounts of end load pressure on the screws as they are tested. The equipment must have a means of holding the test plates in position to do the testing and the equipment must have a timing mechanism capable of being turned on when the test is started. The timing mechanism must also turn off automatically when the piercing screw has penetrated the test plate to a depth where the screw is fully engaged at the thread's full major diameter size.

Configuration and Dimensional Details

The “cone point” drywall screws and metal piercing screws have two configuration details that are critical to their proper driving performance when they are being driven during installation:

1. The points must be consistently sharp. JIS 1125 specifies the point angle to be 25 to 45 degrees. This range is actually too wide to provide fast, consistent metal piercing. Those points closer to 25 degrees tend to drive

faster than those closer to 45 degrees. Experience has indicated that point angles on “cone point” drywall and metal piercing screws held between 25 and 32 degrees provide the best piercing performance.

2. The drivers must engage the screw’s recess or hex parallel to the axis of the thread and the drivers must be tight in the recess or on the hex.

The inclination of the head must not exceed 2 degrees and wobble between the recess and driver bit must not exceed +/- 1 degree. If head inclination and/or recess wobble is not within these limits the drivers will disengage from the parts as they try to pierce the metal they are being driven into. These driving problems result in customer complaints and part rejections.

JIS 1125 can be applied to screws having single or double lead threads regardless of the number of threads per inch, provided the screw’s diameter is listed in the specification.

When customers order drywall screws or metal piercing screws without referring to a particular specification it is recommended that the supplier advise the customer that JIS 1125 is the specification that will be used for manufacturing and testing guidance. Specifying JIS 1125 will provide a means for all parties in a transaction involving drywall screws or metal piercing screws to objectively evaluate the products in the event of dispute or controversy.